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CONTRIBUTIONS TO A SOUTH INDIAN MARINE ALGAL FLORA.—III.

BY

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Communicated by M. O. P. Iyengar

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In this the third and last part of these contributions are enumerated the remaining species of Professor Iyengar's collections which I have been able to determine. Owing to the lack of sufficient material, there being often only a single specimen of each species, the determinations have often been difficult and somewhat uncertain, especially in the case of critical and polymorphic forms of which a large number of specimens are necessary in order to give an account of the variations. I wish to thank Professor Iyengar once more most heartily for his kindness in entrusting me with the work of determining his collection, as it is always very interesting to be able to work on the flora of a more or less unknown area. Professor Iyengar has taken very great interest in my algological researches in South-India. He met me at Karvar and later on during my stay at Tuticorin very kindly arranged for boats and a good working place also there. But for his kind help, I am afraid the result would have been very meagre.

Besides IYENGAR'S collection and my own from Tuticorin, I have received from the British Museum (Nat. Hist.), London, a collection of South-Indian algae for determination. The main part of this consisted of specimens collected by Professor IYENGAR and presented by him to the British Museum. Included in this collection was a small one by EDGAR THURSTON most of the specimens of which were from the Madras beach and a few from Tuticorin.

Finally Professor W. RANDOLPH TAYLOR, Ann Arbor, Michigan, has been kind enough to send me a small collection of South Indian algae for determination. Most of these specimens were collected near Trivandrum, Travancore, and a few were from Krusadi Island, Pamban.

Of the Phæophyceæ and the Rhodophyceæ, (as mentioned already in the previous parts, Professor IYENGAR wishes to investigate the Chlorophyceæ himself), I found in all 38 species of the former and 114 species of the latter, but after investigations of new material from South Indian shores the number is sure to be highly increased. The species of *Sargassum* are not included in the present list. Professor IYENGAR'S collection of this genus has been determined by Professor W. A. SETCHELL and is now at Madras.

Even if it is of course a little too early to say anything about the geographical position of the South-Indian algal flora, I wish to point out that several species, as might be expected, are also found in the flora of Ceylon as well as in the flora of the Indian-Malayan Archipelago. On the other hand many of the species found in the northern part of the Arabian Sea are not met with in the southern part of India.

DR. H. E. PETERSEN has most kindly determined the specimens of *Ceramium* which I have come across in the material. I wish to thank him most sincerely for doing this for me.

As I intend to stop, at any rate temporarily, my investigations of Indian algæ, I wish to thank all those who kindly sent me material of Indian algae and other material for purposes of comparison and who have helped me in other ways, for all their kindness.

I wish to add that the habit illustrations in this part have for the most part been drawn by the young artist, stud. mag. H. HÖVRING and a few by MISS INGEBORG FREDERIKSEN.

To the Trustees of the CARLSBERG FOUNDATION I am greatly indebted for a grant, especially for the preparation of the drawings.

Copenhagen in January 1938.

PHÆOPHYCEÆ

I. Ectocarpales

Fam. I. ***Ectocarpaceæ***

Hecatonema Sauvag.

1. **Hecatonema sargassicola** nov. spec.

Frons plana, ca. 2 mm. alta, maculas plus minus expansas, irregulares in foliis *Sargassi* format. Stratum basale unistratum compositum ex filamentis horizontalibus irregulariter ramosis et sinuosis, inter se conjunctis, articulatis, articulis, diametro (6-7μ longo) plus minus longioribus. Fila erecta dense aggregata, brevia aut longa, ad 2 mm. longa et 6-7μ crassa, sporangia seriata aut sparsa aut terminalia gerentia. Sporangia plurilocularia sessilia aut pedicellata, oblonge ovata, ca. 10-13μ longa et 8-11μ lata.

I n d i a: Cape Comorin, Oct. 1924, leg. M. O. P. I.

This plant forms quite low, soft and dense expansions upto about 2 mm. high on the leaves of a *Sargassum*. The tufts may cover nearly the whole leaf of the host plant and are very irregular in shape and become most probably enlarged owing to the growing together of several small tufts.

The base (Fig. 1a) consists of creeping filaments, which near the edge are more or less free but later coherent. They are composed of irregular roundish-oval or elongated cells about 6-7μ broad and upto 15μ long and 7μ high. From the cells in this disc the erect filaments grow up. Most of the filaments become long, but some remain short, being composed of only a single or a few cells, the uppermost of these cells being transformed into a plurilocular sporangium (Fig. 1a). The long assimilating filaments reach a length of up to about 2 mm. and are 6-7μ thick, and consist of cells 10-20μ long. The cells contain one or more parietal irregularly shaped chromatophores. These were very much damaged as they had been kept for a long time in formalin. Up along the assimilating filaments, often from near their base, but generally in the middle, plurilocular sporangia are developed. The sporangia are sometimes sessile (Fig. 1d), but most often pedicellate, the stalk being composed of a single or two to three cells (Fig. 1b, c). They are as a rule placed unilaterally up along the filaments, a sporangium being developed from nearly every cell in the filaments (Fig. 1b). The sporangia, however, are also often irregularly alternating or scattered (Fig. 1c). Only plurilocular sporangia are found. They are oblong-oval in

shape and about 10-13μ long and 8-11μ broad. When a sporangium is emptied, a new one is often developed from the base of the old one, and as this process may take place several times, the walls of the previous sporangia are often found surrounding the last sporangium (Fig. 1a, c). The terminal cells in the long assimilating filaments are often transformed into a sporangium (Fig. 1f). Once near the apex of a filament, I found a cell which was transformed into a sporangium (Fig. 1g), but this I am sure is quite an exceptional case

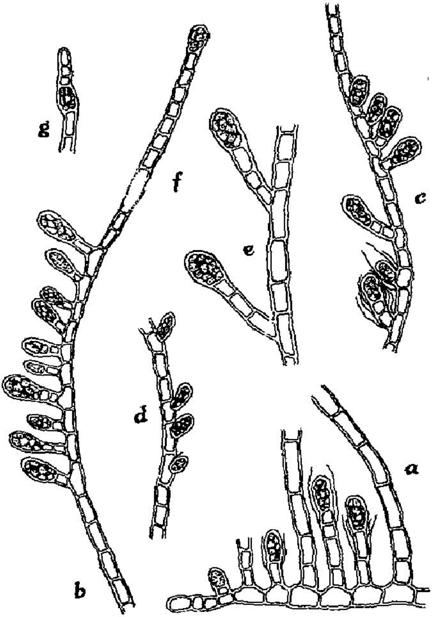

Fig. 1.—*Hecatonema sargassicola* nov. spec. *a*, base of a piece of a plant in transverse section; *b, c, d, e*, parts of filaments with sessile or pedicellate plurilocular sporangia; *f*, terminally placed sporangium; *g*, an intercalary sporangium, *a, e*, × 600; *b, c, d, f, g*, × 450.

As said above, the sporangia may sometimes have a short stipe composed of a few cells, but real branches growing out to long filaments like the mother filaments were not observed by me. I have been looking in vain for hairs. These are evidently completely wanting.

This species seems to be rather closely related to a plant which in The Marine Algae of the Faeröes (Botany of the

Faeröes, part II, Copenhagen 1902, p. 424, fig. 79) I have called *Myrionema faeröense*, but which quite recently in agreement with our present definition of these forms by LEVRING in his valuable paper, Zur Kenntnis der Algenflora der norwegischen Westküste, p. 47, is referred to the genus *Hecatonema*. It is, however, easy to separate the Faeröese plant from the Indian one owing to its much longer, elliptical-cylindrical, plurilocular sporangia. The Indian plant has no hairs and neither did I find any in the Faeröese material examined by me, but LEVRING found hairs in the specimens from the West coast of Norway referred by him to *Hecatonema faeröense*.

II. Sphacelariales

Fam. 1. *Sphacelariaceæ*

Sphacelaria Lyngb.

1. Sphacelaria tribuloides Menegh., Lett. a CORINALDI, p. 2, n. 1 (after DE-TONI, Syll. Alg. vol. III, p. 502). SAUVAGEAU, Remarques sur les Sphacélariacées, p. 123, figs. 28-29 (Journal de Botanique, vol. XV, 1901).

On an old battered and undeterminable stem of a fucaceous plant cast ashore on the beach at Madras some small tufts of this species were present. The plant had propagula and a few unilocular sporangia. *Sphacelaria furcigera* Kütz. mentioned in Part I, p. 359 of these Contributions was found intermingled in the tufts.

India: Madras Beach, Febr. 1900, coll. by EDGAR THURSTON no. 73 (in the British Museum, Nat. Hist., London).

Distr.: Most warm and temperate seas.

RHODOPHYCEÆ

I. Nemalionales

Fam. 1. *Chætangiaceæ*

Scinaia Bivona.

1. Scinaia bengalica Boergs., Two species of Scinaia from South-India (Botaniska Notiser, Lund 1938, p. 89).

India: Madras Beach, Febr. 1900, collected by K. RANGACHARY.

2. Scinaia carnosa Harv. cfr. BOERGESEN, l. c. p. 94.

India: Cape Comorin, Sept. 1900, leg. M.O.P.I.

Distr.: Ceylon, South India.

II. Gelidiales

Fam. 1. Gelidiaceæ

Gelidiella Feldm. et Hamel.

1. Gelidiella Bornetii (Web. v. B.) Feldm. et Hamel in Revue Géner. de Bot., t. 46, 1934, p. 528.—*Gelidium Bornetii* Web. v. B., Algues de l, expedition danoise aux iles Key (Vidensk. Medd. Dansk naturh. Foren., vol. 81, Koebenhavn 1926, p. 107).

A small *Gelidiella* (Fig. 2) creeping on a piece of *Lithothamnion* seems to agree quite well with Mme. WEBER's description. The decumbent creeping filaments are fixed to the substratum by means of vigorous rhizoids. From the basal part the erect filaments arise reaching a height of about 3-5 mm. The filaments are about 100-200μ broad and in the fruiting parts up to 250μ or more. In tranverse sections, they are more or less oval, showing that the thallus is somewhat compressed. They become more so in the upper fruiting parts. In the lower parts of the filaments the cortical cells are quadrangular, higher up they are roundish and somewhat smaller. They are rather distinctly seriately arranged.

While Mme. WEBER's specimens were sterile, the specimens examined by me had tetrasporangia. These occur crowded together in roundish-oblong clumps in the upper somewhat broadened and flattened ends of the erect filaments. The diameter of the tetrasporangia is about 27μ. In a later paper (Résultats Scientif. du Voyage aux Indes orient. Néerlandaises, etc. publiés par V. VAN STRAELEN, vol. VI, fasc. 1, Algues. Bruxelles 1932, p. 20, pl. III, fig. 5-6) Mme. WEBER points out that the thallus traverses the body of the corals. The specimen seen by me was as mentioned above growing on a piece of *Lithothamnion*, and, because of the scarcity of the material I had for examination, I was not able to see if the plant was able to penetrate the thallus of the alga.

In its size, manner of growth and general habit, this plant reminds one of *Gelidiella tenuissima* Feldm. et Hamel, Gélidiales (Revue Algologiques, t. IX, 1936, p. 226, figs. 11-12), but the Indian plant is easy to recognize owing to the different arrangement of its tetrasporangia, these being seriately arranged in *Gelidiella tenuissima*.

I n d i a : Krusadi Island, Sept. 25, leg. M. O. P. I. (no. 55).

D i s t r. : Kei Islands.

2. Gelidiella myrioclada (Boergs.) Feldm. et Hamel, l. c., p. 529.—*Echinocaulon myriocladum* Boergs. in Kew Bull., 1934, p. 5, figs. 4, 5.

A few small sterile specimens fixed to shells and stones were dredged at a depth of about 10 meters. The specimens were not much ramified. The diameter of the thallus was about 100μ.

I n d i a : In the sea off Tuticorin, March 1928 (!).

D i s t r. : Bombay.

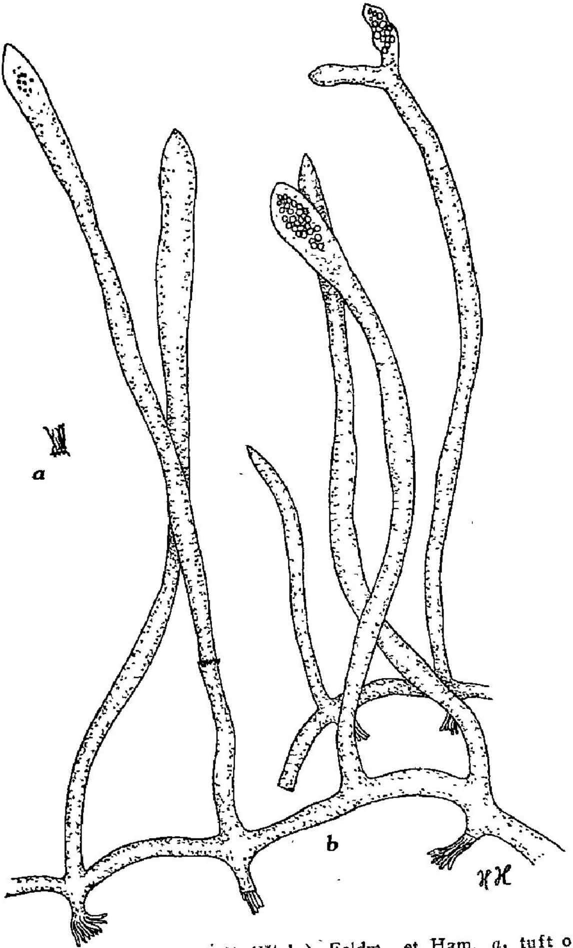

Fig. 2.—*Gelidiella Bornetii* (Web.) Feldm. et Ham. *a*, tuft of the plant (natural size) ; *b*, about. × 20.

3. **Gelidiella acerosa** (Forssk.) Feldm. et Hamel, Observations sur quelques Gélidiacées in Revue Gén. de Bot., t. 46, 1934, p. 528. BOERGESEN, Mar. Algae from Ceylon, p. 80.—*Fucus accrosus* Forssk., Fl. Ægypt-Arab. (1775) p. 190. *Echinocaulon acerosum* (Forssk.) Boergs., Revision Forssk. Algae p. 5. *Fucus rigidus* Vahl, Skrivter of Naturh.-Selskabet vol. 5, Kiöbenhavn 1802, p. 46. *Gelidium rigidum* Grev. in Montagne, Algues de Cuba, p. 45.

India: Kiusadi Island, May, 1924, leg. M. O. P. I.

Distr.: Most warm seas.

Gelidiopsis Schmitz.

1. **Gelidiopsis variabilis** (Grev.) Schmitz.

To this species mentioned in part II of these contributions I believe a slender form collected by me on the shore of the Hare Island near Tuticorin is to be referred. The tufts reach a height of 3-4 cm. and the filaments vary in breadth from about 500μ in the thicker ones to about 100μ in the thin ones. In List mar. Alg. Bombay, p. 44, I have mentioned a similar small form.

India: Tuticorin, Hare Island, March 1928 (!).

Distr.: Indian Ocean.

Gelidium Lamour.

1. **Gelidium micropterum** Kütz., Tab. Phycol., vol. 18, p. 21, pl. 59. Cfr. *Gelidium corneum* (Huds.) Lamour. in Contrib. to a South Indian marine algal flora, I, p. 46.

There has been for quite a long time considerable doubt as to which plant exactly the name *Fucus corneus* Huds. (*Gelidium corneum*) refers. Owing to this uncertainty, DE-TONI in Sylloge gave up altogether employing this name. In 1931 SETCHELL* undertook a very thorough examination and after much investigation arrived at the conclusion that a specimen of BUDDLE's in Herb. SLOANE at the British Museum should be the type specimen of *Fucus corneus*; but alas, this specimen was a form of *Gelidium sesquipedale* Thuret and did not belong to any of the forms (especially of *Gelidium pulchellum* and *G. latifolium*) which have been considered to be *Gelidium corneum*. Because of his discovery SETCHELL is of opinion that *G. sesquipedale* Thuret ought to be called by HUDSON's name. Against this the French algologists FELDMANN and HAMEL, who have contributed so much to our knowledge of the *Gelidiales*, have protested in a recent paper,

* SETCHELL, W. A. Some early algal Confusions (University of Calif. Publicat. in Botany, vol. 16, 1931, p. 358).

Floridées de France. Gélidiales, in Revue Algologique, t. IX, p. 230. They point out that taking up for *Gelidium sesquipedale* the very ambiguous name *corneum* as proposed by SETCHELL will be a source of constant mistakes and confusion, and they think it would be best to let the name sink into oblivion for ever.

I refer the reader to FELDMANN and HAMEL's papers as well as to that of SETCHELL, so that I need not go into details regarding this question, but I wish to point out that, in agreement with the above mentioned authors, it seems better to give up using the specific name "*corneum*", at any rate for the plant, which in the first part of these Contributions, p. 46, and in List mar. Alg. Bombay, p. 43, and in Some Marine Algae from Ceylon, p. 80, has been called by the specific name *corneum* and instead to take up KÜTZING's name *Gelidium micropterum* with the figure of which the specimens from India and Ceylon agree very well.

India: Cape Comorin, Sept. 1924, leg. M.O.P.I.

Distr.: Cape, India.

III. Cryptonemiales.

Fam. I. ***Corallinaceæ.***

Amphiroa Lamour.

1. **Amphiroa fragilissima** (L.) Lamour., Hist. Polyp. Corallig. Flexib. p. 298. ARESCHOUGH in J. AGARDH, Spec. Alg., p. 531. WEBER VAN BOSSE, and M. Foslie. The Corallinaceæ of the Siboga-Exp. p. 89, pl. XVI, figs. 1, 2, 5. — *Corallina fragilissima* L., Systema Nat., ed. 12, I, p. 1305.

India: Pamban, Oct. 1922, leg. M.O.P.I.

Distr.: Much distributed in warm seas.

Cheilosporum Aresch.

1. **Cheilosporum spectabile** Harv., Friendly Island Algæ no 31 (nomen nudum). GRUNOW, Alg. Fidschi, etc. p. 41. WEBER VAN BOSSE and Foslie The Corallinaceæ of the Siboga-Exp., p. 106.

Some specimens found at Karvar agree very well with the form found by me at Bombay; compare the figure 23 in "List mar. Alg. Bombay", p. 51—52. The specimens were sterile.

India: Karvar, Febr. 1928, leg. M.O.P.I., (!).

Distr.: Malayan Archipelago, Bombay, Polynesia.

Jania Lamour.

1. **Jania rubens** (L.) Lamour., Hist. Polyp. Corallig. Flexib., p. 272. ARESCHOUGH in J. AGARDH, Spec. Alg., II, p. 557. KUTZING, Tab. Phycol., vol. VIII, tab. 84.

A few specimens in IYENGAR'S collection seem referable to this species; the thallus is about 120-150μ thick.

India: Cape Comorin, Sept. 1924, and Krusadi Island, "on coral stones," leg. M.O.P.I.

Distr.: Seems to be much distributed in warm seas.

Fam. 2 *Grateloupiaceæ*

Halymenia Ag.

1. **Halymenia dilatata** Zan in Flora, 1851, p. 35; Plant. mar. Rubr enum. p. 72. tab. III, fig. 1. J. AGARDH, Analecta Algologica. 1892, p. 53. Okamura, Icones, vol. IV, p. 109, pl. 176 et 177, figs. 3-4

From Malvan I have seen a dried female specimen which agrees very well with ZANARDINI'S description and figures with the exception of the thallus not being maculated. A transverse section of the thallus shows that, under the rather thin cortical layer composed of small roundish or oblong cells. thin irregularly bent filaments run in all directions into the slimy interior. But I have not seen any authentic specimen for comparing with it.

The specimen was collected and most kindly sent to me by Mr. S. C. DIXIT, BOMBAY.

I wish to add that in the collection of the British Museum (Nat. Hist.) a single small specimen is present which agrees fairly well with ZANARDINI'S figure in having a maculated thallus, but the structure of the thallus is different from that of the above-mentioned specimen from Malvan, since its cortical cells are much larger, the filaments in the interior are few, and, when soaked in water, the transverse sections are slow to assume their natural size. This specimen is tetrasporic, the tetrasporangia being cruciately divided. It was collected at the Madras Beach, Febr. 1900 Coll. EDGAR THURSTON (no. 76). If the first mentioned specimen is correctly named, thus belonging to *Halymenia dilata*, the latter is surely another species, but, in order to decide this, more and better preserved material is necessary.

Distr.: Red Sea, Somaliland, Malayan Archipelago, Japan.

Grateloupia C. Ag.

1. **Grateloupia filicina** (Wulf.) Ag., compare BOERGESEN, Mar. Alg. Bombay, p. 53, where literature is quoted.

Specimens with tetrasporangia were gathered in February, 1928.

India: Tuticorin, M. O. P. I.

Distr.: Most warm seas.

2. **Grateloupia lithophila** nov. spec.

Frondes cæspitosæ, planæ, undulatæ et sinuosæ, lanceolate-lineares, ad 12 cm. altæ et ca. ¼-1 cm. latæ, a media parte utrinque attenuatæ, simplices aut irregulariter divisæ, marginibus nudis, aut in superiore parte thalli, ubi thallus sæpe truncatus est prolificationes gerentia.

Substantia, ut videtur, gelatinose-membranacea, specimina exsiccata chartæ arctius adhærent. Color brunneo-olivaceus in violaceum transiens.

Tetrasporangia cruciatim divisa per totam frondem sparsa.

India: Madras, Jan. 1926, leg. M.O.P.I. no. 370 (type); ibid. Febr. 1900 leg. K. RANGACHARY (specimens in Herb. IYENGAR and in the British Museum (Nat. Hist.).

The plant (Plate VII) grows in tufts upon stones near the shore and reaches a height of about 12 cm.; the breadth of the thallus varies very much from about ¼-1 cm. The thallus is simple or divided, linear-lanceolate, tapering from the middle towards both ends; it is flat and more or less sinuate and undulating. The upper ends of the fronds are often truncate becoming more or less broadly rounded, and from the upper ends of these fronds proliferations are usually given out; otherwise the margins are as a rule bare.

The colour of the dried specimens are mostly dark olive-brown with an occasional tinge of violet. The plant adheres strongly to paper and when alive is sure to have been slippery. Only tetrasporic specimens are present; the tetrasporangia are cruciately divided and scattered over the surface of the plant.

As to the shape of the thallus this species seems to have an intermediate position between *Grateloupia prolongata* J. Ag. and forms of *Grateloupia cuneifolia* J. Ag. with narrow leaves. DE-TONI in Sylloge IV, p. 1565, mentions that *Grateloupia prolongata*, according to PICCONE, was found at Colombo, Ceylon. The plant referred to by Piccone is most probably the same as the one described here. This species seems also to resemble *Gr. furcata* Holmes, but, according to the description, HOLMES's plant, of which I have seen no specimens, is rather regularly dichotomously divided and does not taper towards the apex and, if so, only very little.

Fig. 3.—*Grateloupia Comorinii* Boergs.—About 2/3 natural size.

3. Grateloupia Comorinii nov. spec.

Frondes usque ad 30 cm. altæ, gelatinose-carnosæ, membranaceæ, a disco parvo basali solitariæ aut gregatim proveniunt, simplices aut plus minus divisæ, denique sæpe valde irregulariter formatæ.

Frons basi late cuneata, nunc oblonge-lanceolata, nunc late-obovata, superne sæpe plus minus truncata, marginibus sinuosis et undulatis, integerrimis aut hic illic prolificationes numerosas gerentibus. Color brunneo-violaceus.

Tetrasporangia cruciatim divisa per totam frondem dispersa.

India: Cape Comorin, Sept. 1924, leg. M.O.P.I. no 274 (type).

From a small basal disc a very short stripe arises which immediately is broadened out making an even transition into the leaf-like frond; in some cases a few (2-4) fronds issue from the disc or from the lowermost part of the stipe. The base of the frond is cuneate, but otherwise the shape of the plant (of which I have seen altogether 7 specimens) varies very much (Figs. 3 and 4). In some of the specimens it is elongated-obovoid and gradually tapering upwards, in others rather abruptly truncate, which is due probably to some sort of damage. The upper margins in these truncate specimens are more or less deeply sinuate or laciniate (Fig. 3). In one specimen the frond was rather deeply divided into two halves. The margins of the thallus are more or less sinuate and undulating While some of the specimens are quite or almost completely destitute of proliferations having an entire and even margin (Fig. 4), others have a great number of smaller or larger proliferations developed generally somewhat above the base. These proliferations are, however, most numerous and vigorous along the upper margins of the truncate specimens (Fig. 3).

To illustrate the size of the plant, I wish to give here the measurements of some of these. A small specimen (Fig. 4a) with an oblong elongated frond tapering gradually upwards and with nearly entire margins was 14 cm. long and 5¼ cm. at its broadest, which is 4½ cm. above the stipe. Another larger specimen (Fig. 4b) with an oblong-linear frond and rather undulated margins and a few rather large proliferations was 31 cm. long and about 6 cm. broad. The specimens with truncate ends were proportionately much broader; thus the frond in the specimen shown in Fig. 3 was 16 cm. long and 11½ cm. broad near its upper end at its broadest.

The proliferations are generally elongated ellipsoidal and have often rather broad bases tapering from the middle towards the generally acute summit. Their size varies much from quite a small one up to about 2 cm. long and ½ cm. broad or a little more.

Fig. 4.—*Grateloupia Comorinii* Boergs.— about 3/5 natural size.

Judging from the fact that the plant adheres strongly to paper, the thallus must have been mucilaginous and slippery. The colour of the dried plant is brownish-purple with dirty yellow-greenish spots, especially in the basal parts. The sporangia are developed in the cortical layer and are scattered over the thallus; they are cruciately divided.

This species differs from *Grateloupia Cutleriæ* (Bind.) Kütz. (comp. De-Toni, Syll. IV, p. 1569) in having a different shape of the thallus and in the absence of proliferations on the surface of the thallus and also in the broadly cuneate base above the stipe. *Grateloupia Wattii* Holmes (in Journ. of Botany, vol. 38, 1896, p. 351) from Verawal, Kathiawar, India, differs according to the description in its palmately divided thallus having only a very few proliferations. The size of *Gr. Wattii* is not mentioned in the description. *Grateloupia indica* Boergs. (Kew Bulletin, 1932, 3, p. 119) differs in its much larger, oblong-linear thallus which often is much divided, in its often perforated thallus and also in its proliferations being formed only occasionally.

IV. Gigartinales

Fam. 1. **Solieriaceæ**

Sarconema Zan.

1. **Sarconema furcellatum** Zan., Pl. Mar. Rubr. Enum., p. 56, pl. 8.

A single rather robust specimen is perhaps referable to this species. Its thallus reaches a breadth of 1½ mm. The filaments are only furcated a few times with long distances between the furcations. In the upper parts of some of the branches densely placed proliferations are present. The specimen is tetrasporic.

India: Cape Comorin, Sept. 1924, leg. M.O.P.I. (no. 296 A).

Distr.: Red Sea, Arabian Sea.

2. **Sarconema filiforme** (Sond.) Kylin, Die Florideenordnung Gigartinales (Lund's Univ. Årskr. N.F. Avd. 2. vol. 28, Nr. 8, p. 22, 1932).

A piece of a plant with repeatedly and regularly furcated thallus is most probably referable to this species; its thallus near the base is about 1 mm. thick tapering slowly upwards to about half that size. It resembles very much the specimens I have gathered at Bombay and referred to this species (Kew Bulletin 1934, p. 11).

India: Cape Comorin, Sept. 1924, leg. M.O.P.I. (no. 286 B).

Distr.: West Australia, Arabian Sea.

Fam 2. **Rhodophyllidaceæ**

Callibleparis Kütz.

1. **Calliblepharis Jubata** (Good. et Woodw.) Kütz., Phycol. gen. p. 404; Tab. Phycol. vol. 18, pl. 13 a. b. J. AGARDH, Spec. Alg. II, p. 620; Epicr., p. 433—*Fucus jubatus* Good. et Woodw. in Linn. Transact. vol. III, p. 162, pl. 17, fig. 2, London 1797. For more literature compare DE-TONI, Syll. Alg., vol. IV, p. 466.

In a collection of some Indian algae belonging to the University of Michigan and sent to me for determination by Professor W. RANDOLPH TAYLOR, Ann Arbor, a fine well prepared specimen is present showing a very great likeness to this plant.

In shape it agrees completely with specimens from the Atlantic shore of France collected for instance by THURET or LE JOLIS. The specimen is 24 cm. high and much divided with narrow, up to 7 mm. broad, segments up along the margins of which numerous proliferations are present; such proliferations are found on the flat sides of the thallus also. The specimen is tetrasporic. The zonately divided tetrasporangia are found both in the main lobes and in the proliferations, the plant in this respect seeming thus to have an intermediate position between *Calliblepharis ciliata* (Huds.) Kütz. in which species the tetrasporangia occur in the frond ("sphærosporis in fronde aggregatis," cfr. J. AGARDH, Epicrisis, p. 433) and *Calliblepharis jubata* where they occur in the proliferations ("sphærosporis in ciliis numerosis", cfr. J. AG., l c.). The specimen as mentioned above agrees in its shape so well with the last mentioned species that I have referred it to this species until more, also cystocarpic, specimens can be examined. But the occurrence of such a characteristic plant so far from its previously known area of distribution may of course arouse some doubt as to the correctness of its determination.

In the northern part of the Arabian Sea, *Calliblepharis fimbriata* seems to be common to judge from the rather numerous specimens I have seen in collections from that place, but I have not come across any specimens of *Calliblepharis jubata* there.

The plant was collected by E. W. ERLANSON at Trivandrum, Travancore. No dates are given, but ERLANSON together with E. K. JANAKI has gathered several other algae, *e.g.*, *Chondria armata* in that locality in Jan. 1934 and the *Calliblepharis* was most probably collected in the same month.

Distr.: Atlantic shores of Europe from Scotland southwards to Morocco; Mediterranean Sea.

Fam. 3. **Hypneaceæ**

Hypnea Lamour.

1. Hypnea musciformis (Wulf.) Lamour. Cfr. Boergesen, Contributions, I, p. 47.

A few more specimens of this species most probably common along the Indian coasts are found in Iyengar's collection.

India: Cape Comorin, Pamban, leg. M.O.P.I.

Distr.: Most warm seas.

2. Hypnea valentiæ (Turn.) Mont. Cfr. Boergesen, l.c. p. 47.

Several other specimens of this highly variable plant are found in Iyengar's collection. Referring the reader to my remarks (l.c.), I wish to add that some of the specimens mentioned there, especially those referred with reservation to *H. spicifera*, might also be compared with *H. flagelliformis* Grev. collected by Wight at Madras. Of this plant I have seen specimens in J. Agardh's herbarium in Lund. Its numerous quite short branchlets which are protruding on all sides and covering the filaments quite densely are characteristic of this plant. But no specimens quite like those in J. Agardh's herbarium are found in Iyengar's collection.*

India: Tuticorin, Hare Island (!). Krusadi Island, Pamban, leg. M.O.P.I.

Distr.: Most warm seas.

Fam. 4. ***Gracilariaceæ***

Gracilaria Grev.

1. Gracilaria confervoides (L.) Grev., Alg. Brit., p. 123. J. Ag., Spec. p. 587; Epicr., p. 413. Harvey, Phycol. Brit., t. 65.—*Fucus confervoides* L. Spec. plant., II, p. 1629. Turner, Fuci, tab. 84. For more literature comp. De-Toni, Syll. Alg., IV, p. 431.

Some specimens in Iyengar's as well as in my own collection are, I think, referable to this species. Specimens altogether typical I have not seen, and I think it is difficult to separate them from *Gracilaria lichenoides*.

India: Tuticorin, Hare Island, Febr. 29, female specimens, leg. M. O. P. I., (!); Krusadi Island, Apr. 1924, leg. M. O. P. I.; Pamban, Oct. 1922, leg. M. O. P. I.

Distr.: Much distributed in warmer seas.

*I wish to point out also that Wight at Madras has found another *Hypnea*, *H. nigrescens* (Grev.) J. Ag. (Alg. Liebmann, p. 14; Spec. Alg. vol. II, p. 443). No specimens of this species, which is represented in J. Agardh's herbarium, Lund, are found in Iyengar's collection.

2. **Gracilaria disticha** J. Ag., Spec. Alg., II, p. 594; Epicr. p. 416. *Sphærococcus distichus* J. Ag., Alg. Rueppel, p. 172.

A few specimens in IYENGAR's collection seem referable to this species. I have compared them with authentic specimens in J. AGARDH's Herbarium in Lund and found that they agree very well with them.

India: Krusadi Island, Pamban, May 1924, leg. M. O. P. I. and "Coll. by K. RANGACHARY" (without locality).

Distr.: Red Sea, India.

3. **Gracilaria Fergusoni** J. Ag., Spec. Alg., Vol. III, 4, p. 60, 1901.

A few specimens (one dried and some in formalin) seem to agree quite well with the description of this species based upon specimens gathered by FERGUSON on the shores of Ceylon. But I wish to point out that I have not been able to compare the Indian specimens with original ones.

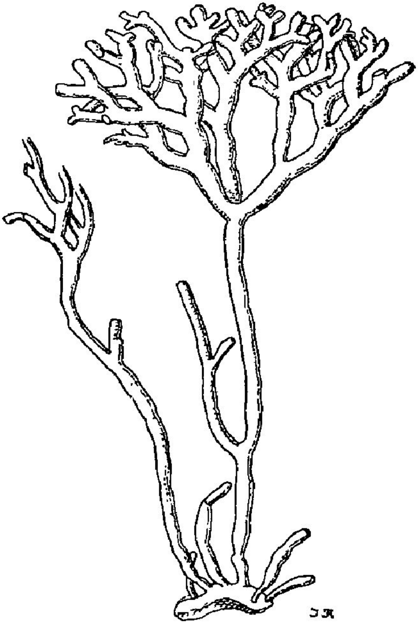

Fig. 5.—*Gracilaria Fergusoni* J. Ag. Habit of a plant. A little magnified.

The figure (Fig. 5) drawn from a specimen preserved in formalin shows a part of the plant. The plant grows most probably in exposed places in dense tufts about 6-7 cm. high. The base consists of a flat, more or less expanded disc. from which young as well as old erect shoots grow up intermingled. The thallus is terete, cylindrical, now and then somewhat narrowed, in the lower part about 2½mm. thick tapering slowly a little upwards to about 1½mm. at the upper ends; the apices of the branches are broadly rounded. As the ramification generally only begins at about half the height of the erect shoots the young ones up to this height are unramified. When the ramification begins the shoots are divided into two or three branches and these are once more pseudodichotomously divided several times, the branches growing in a fanlike manner in about the same plane and becoming shorter upwards.

A transverse section (Fig. 6) shows that the medullary layer is composed of rather small (about 80μ broad) cells with rather thick walls and of almost the same size until approaching the periphery where the cells become smaller and more oblong in transverse section. The cortical layer consists of quite small cells and is covered by a thick cuticle. The specimens were sterile.

When I tried to determine this plant, I began referring it to *Gracilaria obtusa* Grev. in KÜTZING, Tab. Phycol., vol. 19, p. 8, pl. 21; compare also WEBER Algues Siboga, p. 436. The fragments figured here by KUTZING under the name of *Sphærococcus obtusus* might of course originate from a plant resembling the Indian plant, but this evidently cannot be the case, because one of the three specimens found under *Gracilaria obtusa* in Mme. WEBER'S Herbarium (in which KÜTZING'S herbarium is incorporated) is a specimen of HARVEY'S Ceylon Algæ no. 30, and the two others were gathered at Ceylon by SCHMARDA. According to this statement these specimens must be presumed to be like *Corallopsis cacalia* Harvey = *Corallopsis opuntia* J. Ag., a plant which I am rather inclined to consider a form of *Gracilaria crassa* (compare my remarks in "Some Marine Algae from Ceylon," p. 86, fig. 8 and in "Contrib. to a South Indian mar. alg. Flora," II, p. 328-9). KÜTZING'S figure quoted above agrees quite well with this species. To *Gracilaria obtusa* Mme. WEBER refers also *Gracilaria canaliculata* (Kütz.) Sonder from Nova Caledonia and figured in KÜTZING'S Tab. Phycol., vol. 18, pl. 82 This figure too, drawn from a rather fragmentary and badly preserved specimen might very well show a plant referable to *Gracilaria crassa*. Mme. WEBER has also found that its thallus is really terete.

Owing to this I am very much inclined to believe that the rather dubious species *Gracilaria obtusa* Grev = *Sphærococcus*

obtusus (Grev.) Kütz.* from India and Ceylon is nothing but *Gracilaria crassa* (Harv.) J. Ag. From this plant *Gracilaria Fergusoni* is easily separated not only because of its quite different habit, but also because transverse sections of the two plants are very different, the medullary tissue of *Gr. crassa* consisting of cells more than twice as large as those of *Gr. Fergusoni* and having thin walls, making the thallus collapse very much, so as to give it a canaliculate appearance.

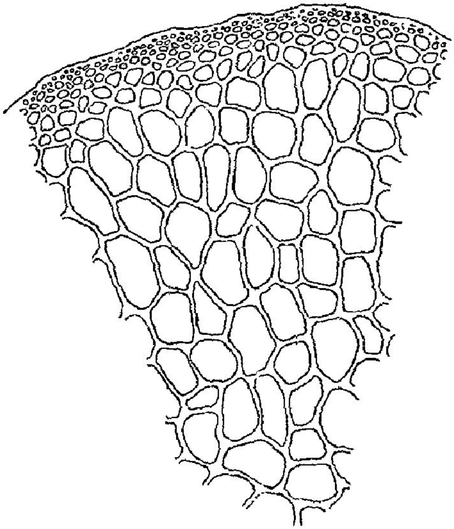

Fig. 6.—*Gracilaria Fergusoni* J. Ag. Transverse section of the thallus × 85.

Both IYENGAR and I gathered near Tuticorin a small form which, leaving its smaller size out of consideration, seems to agree very well in habit with *Gracilaria Fergusoni*. A transverse section shows that its cells are small, of about the same size as the big form.

I n d i a : Cape Comorin, Sept. 1924, M. O. P. I. Tuticorin, Oct. 1923, M. O. P. I. and March 1928 (!).

D i s t r. : Ceylon.

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* Compare also J. AGARDH, Spec. alg., vol. II, p. 590 Obs. and *Gigartina obtusa* (Grev.) J. Ag., Epicr. p. 426.

4. **Gracilaria debilis** (Forssk.) Boergs., Revision FORSSKÅLS Algæ, etc., p. 7.—*Gracilaria Wrightii* (Turner) J. Ag., Spec. Alg., II, p. 599; Epicr. p. 422; III, 4, p. 78. *Fucus Wrightii* Turner, Fuci, pl. 148.

It is not without doubt that I refer a female specimen in IYENGAR'S collection to this species. I have not been able to compare it with specimens from the Indian Ocean, but, compared to specimens from the West Indies, it has a somewhat thinner and less fleshy thallus. Otherwise the specimen seems to agree quite well with the description of J. AGARDH.

India: Krusadi Island. Pamban, Oct. 1924, leg. M.O.P.I.

Distr.: Indian Ocean, Red Sea, West Indies.

5. **Gracilaria corticata** J. Ag., Spec. alg., II, p. 602; Epicr., p. 423.—*Rhodomenia corticata* J. Ag., Symbolæ in Linnæa, XV, p. 14, 1841.

It seems often rather difficult in the Indian material to separate *Gracilaria corticata* from *Gracilaria foliifera.* In Kew Bulletin 1933, p. 124, I have tried to point out some of the characters by means of which it might perhaps be possible to separate these two species basing my point of view essentially on J. AGARDH'S descriptions. Later I have had the opportunity to see the specimens of *Gr. corticata* in J. AGARDH'S Herbarium in Lund. Most of these have a narrow almost linear thallus; one of the plants with a somewhat broader thallus was a specimen of HARVEY'S Ceylon Alg. no. 28. This species was originally described by J. AGARDH from specimens from Ceylon, leg. REYNAUD (Herb. Paris). These specimens I have not seen, but, as they are from Ceylon and as J. AGARDH refers HARVEY'S Ceylon Alg. no. 28 to this species, it is to be presumed that this plant comes near to the original specimens. We have in the Botanical Museum, Copenhagen, a specimen of HARVEY'S plant. Its thallus is about 2 mm. broad tapering a little upwards, the upper ends being obtuse.

In IYENGAR'S collection several specimens are, I think, referable to this species. Some of these are rather like HARVEY'S above mentioned specimen, their thallus being rather regularly subdichotomously divided with segments about 2 mm. broad and with obtuse apices. Other specimens are more irregularly divided with more or less cuneate elongated segments tapering gradually upwards and with acute apices resembling very much ESPER'S figure, Tab. 50, in Abbildungen der Tange. Finally IYENGAR'S collection contains a few specimens with narrow linear thalli like those found in AGARDH'S herbarium.

But, as I have already said, I find it difficult to separate this species and especially forms with broad thalli from *Gracilaria foliifera.* I was therefore interested to find that HAUCK in

Hedwigia, 1888, p. 89, has come to the same conclusion. He writes: "Sowohl in schmal-als auch in sehr breitlaubigen Formen vorkommend, welch letztere mit di-polychotom getheilten Thallus *und bis 10-15 mm. breiten Segmenten sich gar nicht von der* typischen *Gracilaria multipartita** unterscheiden lassen".

India. Karvar, Febr. 18th 1928, leg. M.O.P.I.; Tuticorin, Hare Island, March 2nd 1928, leg. M.O P.I. (!); Cape Comorin, Sept. 1920, leg. M.O.P.I In IYENGAR's collection presented to the British Museum some specimens from this locality are also found. Mahabalipuram, Jan. 1923, leg. M.O.P.I. Madras Harbour, Aug. 3rd 1924, leg. M.O.P.I.

Distr.: Indian Ocean, Red Sea.

6. Gracilaria foliifera (Forssk.) Boergs.

This species has already been mentioned in part I of these Contributions on page 48. A few more specimens in IYENGAR's collection are to be referred to it. Some of these resemble very much forma *æruginosa* Turner (*Fucus æruginosus* Turner, Hist. Fucorum, tab. 147). One of the plants (coll. by K. RANGACHARY, but without locality) is a rather slender form; in the British Museum (Nat. Hist.), London, some undetermined specimens resembling this form are found. Another specimen (cystocarpic) in shape and colour reminds one of forma *granatea* (*Fucus granateus* Turner, l. c. p. 215).

India: Cape Comorin, Sept. 1924, (f. *granatea*); Krusadi Island, Pamban, April 1924 (f. *æruginosa*), leg. M.O.P.I.

V. Rhodymeniales

Fam. I. ***Rhodymeniaceæ***

Rhodymenia Grev.

1. Rhodymenia dissecta nov. spec.

Frons plana, membranacea, ca. 20 cm. longa et ultra, basi cuneata, ad apicem versus sæpius dichotome-flabellatim divisa, ex segmentis sublinearibus ca. 3-8 mm. latis, axillis subacutis discretis, dichotomiis 2-6 cm. distantibus composita. Segmenta ad apicem versus plus minus angusta, apicibus obtusis vel subacutis. Segmenta basalia in marginibus prolicationes majores gerentia. In superiori parte thalli margines integerrimi sunt aut rarissime proliferi.

Tetrasporangia cruciatim divisa per totam superficiem thalli sparsa. Cystocarpia hemisphærica marginalia aut in disco thalli dispersa.

India: Tuticorin, Sept. 1900, leg. K. RANGACHARY. Specimina in Herb. IYENGAR and the British Museum (Nat. Hist.).

* *Gracilaria multipartita* is a synonym of *Gracilaria foliifera.*

The thallus (Fig. 7) in the largest specimen is divided up to six times. The breadth of the segments varies as a rule from 3 mm. to ¾ cm. The angle between the segments is acute with a

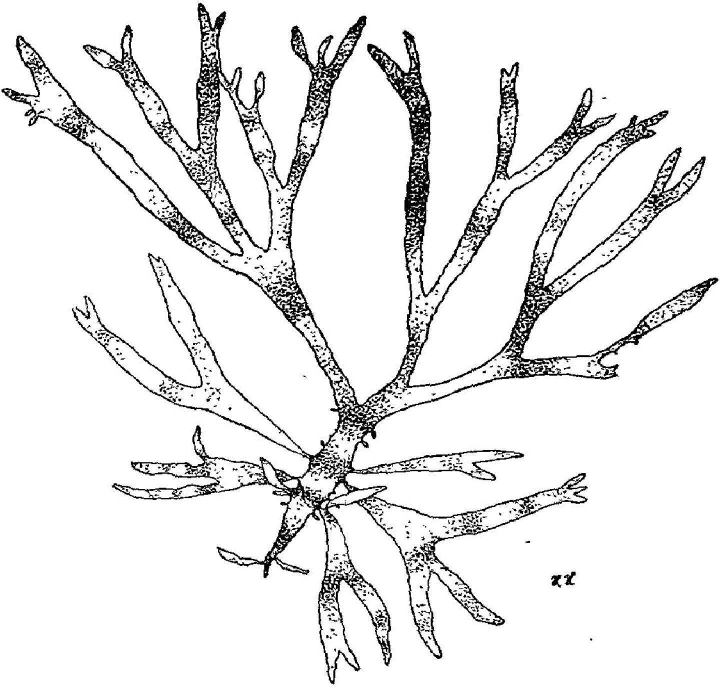


Fig. 7.—*Rhodymenia dissecta* Boergs.—about half the natural size.

more or less roundish base, and the distance between the dichotomies is 2-6 cm. The plant is fixed to the substratum by means of a small disc from which the elongated cuneate basal segments arise along the margins of which on both sides a row of proliferations (3-5 in each row) are developed. These proliferations are divided as the main thallus but only about twice, and their segments reach about the same breadth. Altogether I have seen two large tetrasporic specimens and a small female one of this plant and also a small specimen which I am not sure belongs to this species. In the large specimens the margins above the basal segment are smooth and without proliferations except for a

w small ones. The small specimen, on the other hand, not only .d very many small proliferations along the basal segment, but ıch ones also occurred in a scattered manner, higher up in the lant but in decreasing numbers. The thallus is thin, papery ınd brittle when dried. I have not succeeded in making it ıssume its natural shape by soaking it in water. Except in the case of the small specimens, it does not adhere very well to paper. The colour of the dried specimens is dirty red-violet to brownish. Three of the specimens are tetrasporic; the tetrasporangia occur scattered over the whole thallus. The fourth specimen is a female one and the cystocarps are likewise developed scattered over the whole thallus. The two bigger specimens of which one (Fig. 7) belongs to the herbarium of the British Museum (Nat. Hist.), Coll. EDGAR THURSTON, and the other one to Prof. IYENGAR, have both no. 24 and are tetrasporic and have been collected Sept. 15th 1900. The small female specimen belongs to IYENGAR's herbarium and has no. 37 and is dated Sept. 16th 1900, and from the same date is the small somewhat different specimen which has no. 36 and belongs to the British Museum.

Since the tetrasporangia are scattered over the whole thallus, this species belongs to the group *Palmatæ* J. Ag., Spec. Alg. p. 376, but judging from the descriptions of the species referred to this group, it seems to be related to none of them.

VI. Ceramiales

Fam. 1. **Ceramiaceæ**

Sub-fam. 1. ***Griffithsieæ***

Griffithsia C. Ag.

1. Griffithsia spec.

Several sterile specimens are found in IYENGAR'S collection. They remind one very much of KÜTZING'S figure of *Griffithsia opuntioidas* in Tab. Phycol. Vol. XI, pl. 27, but as they are sterile they are undeterminable.

India: Cape Comorin, Sept. 1924, leg. M.O.P.I.

Sub-fam. 2. ***Ceramieæ***

Ceramium (Roth) Lyngbye

In IYENGAR'S collection I have occasionally come across the bottles some pieces of *Ceramium* as epiphytes on larger al; or mingled with these. Dr. H. E. PETERSEN has been so kind to identify them and the result is the following list.

1. **Ceramium strictum** Grev. et Harv. in HARVEY, Phycologia Brit., pl. 334. J. Agardh, Spec. alg., vol. II, p. 123; Epicr., p. 97.

Some small sterile fragments only are found.

India: Cape Comorin, Oct. 1924, leg. M.O.P.I.

Distr.: Warm parts of the Atlantic Ocean, Mediterranean Sea.

2. **Ceramium cruciatum** Collins and Herv., Alg. Bermuda, p. 144, pl. IV, figs. 27—28. WEBER VAN BOSSE, Algues Siboga, p. 331, fig. 122.

Tetrasporic specimens are found in one of the collections.

India: Krusadi Island, Pamban, Oct. 1924, leg. M.O.P.I.

Distr. West Indies, Malayan Archipelago.

3. **Ceramium transversale** Collins & Herv., Alg. Bermuda, p. 145, pl. V. figs. 29—31. BOERGESEN, Mar. Alg. D.W.I., vol. II, p. 243, fig. 233; Marine Algae Beata Island, p. 27, fig. 9. —*Ceramium byssoideum* Harv., HOWE in BRITTON, Flora of Bermuda, Algae, p. 531. *Ceramium gracillimum* Griff. et Harv., Kew Bulletin, 1934, p. 19.

When Dr. H. E. PETERSEN in 1934 was kind enough to determine the species of *Ceramium* in my Indian collection, he was at that time inclined to consider *Ceramium transversale* to be like *Ceramium gracillimum* Griff. et Harv., but added that authentic material was necessary in order to be quite certain regarding this. Recently Dr. PETERSEN has been able to say with certainty that *Ceramium gracillimum* is quite a different plant, having for instance gland-cells which are not found in *Ceramium transversale*.

A few small specimens are found in IYENGAR's collection.

India: Royapuram, Madras, Aug. 1924, leg. M.O.P.I. As mentioned in Kew Bull. 1934, I have found this species near Tuticorin.

Distr.: Seems to occur in most warm seas.

4. **Ceramium truncatum** H. E. P. in BOERGESEN, Mar. Algae from Ceylon (Ceylon Journ. of Sc., Botany, vol. XII, 1936, p. 91, fig. 11, 12).

Tetrasporic specimens were found as epiphytes on leaves of *Sargassum*.

India: Cape Comorin, Oct. 1924, leg. M.O.P.I.

Distr. Ceylon.

5. Ceramium subdichotomum Web. v. B., Algues Siboga, p. 333, fig. 125.

Tetrasporic specimens are met with in some of the collections.

India. Tuticorin, Hare Island, Febr. 1928, leg. M.O.P.I. Krusadi Island, Pamban, April 1924, leg. M.O.P.I.

Distr.: Malayan Archipelago.

6. Ceramium Maryae Web. v. B., Algues Siboga, p. 324, figs. 117 and 118.

A single sterile specimen was found creeping on *Enantiocladia prolifera.*

India: Cape Comorin, Oct. 1924, leg. M.O.P.I.

Distr.: Malayan Archipelago.

Fam. 2. ***Rhodomelaceæ***

Sub-fam. 1. ***Laurencieæ***

Laurencia Lamour.

1. Laurencia paniculata J. Ag., Spec. Alg., p. 755; Epicr. p. 651. YAMADA, Notes on Laurencia, p 192, pl. 3, fig. a, 1931.

In IYENGAR'S collection two small specimens are found which resemble very much the small specimens from Ceylon referred by me to this species in "Some marine Algae from Ceylon" 1936, p. 93. The peripheral cells have the shape of palisades. These specimens came from pearl-beds near Tuticorin.

Furthermore, a few somewhat larger specimens from Cape Comorin are perhaps referable to this species. The peripheral cells of these specimens also are palisade-like with thick walls. IYENGAR has presented some specimens collected from this locality to the British Museum.

India Pearl-bed near Tuticorin, March 3rd, 1928 and Cape Comorin, Sept. 1920, leg. M.O.P.I.

Distr.: Mediterranean sea, Ceylon.

2. Laurencia obtusa (Huds.) Lamx.

Several specimens varying in form, size and development are found in IYENGAR'S collection, but as a rule only a single specimen of each form is present. One of the specimens seems to belong to the var. *divaricata* J Ag. resembling very much the figure of the type-specimen in J. Agardh's herbarium figured in YAMADA'S paper: Notes on Laurencia, pl. 16 a. Another one, I think, is referable to the var. *majuscula* Harv., resembling the plant mentioned in Kew Bulletin 1933, p. 135, and having the same fine red colour. Compare also YAMADA'S figure l. c. pl. 16 c.

A small slender plant is very much like var. *gracilis* Kütz., Tab. Phycol., vol. 15, p. 20, tab 54. figs. c, d. Fig. 8 shows a piece of this plant. Thickened walls are not present in the medullary layer. I dredged this plant at a depth of about 20 meters. It had tetrasporangia in March.

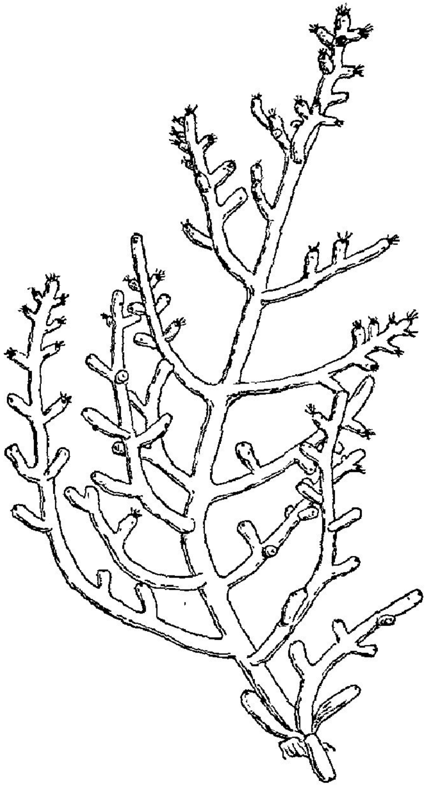


Fig. 8 —*Laurencia obtusa* (Huds.) Lamx. var. *gracilis* Kütz. Part of a plant × 5.

Furthermore, a small incomplete specimen shows much likeness to the var. *rigidula* Grunow, Alg. Fidschi. Tonga und Samoa-Inseln, p. 45. The divaricate, as a rule oppositely or verticillately placed branchlets are characteristic of this variety. It shows, as mentioned by GRUNOW, very great likeness to

KÜTZING's figure of *Laurencia corymbifera* from the West Indies in Tabulæ Phycol., vol. XV, tab. 56. The specimen is collected by K. RANGACHARY, but the locality is *not mentioned.*

India: Off Tuticorin (!), Cape Comorin and Pamban Bridge, leg. M.O P.I.

Distr.: Warmer Seas.

Sub-fam. 2. Chondrieæ

Chondria Ag.

1. Chondria transversalis nov. spec.

Thallus ca. 1-2 cm. altus, filiformis, teretiusculus, ad 450μ latus, ramosus ex ramis decumbentibus, rhizoideis adfixis et ramis erectis compositus. Apex ramorum truncatus, punctum vegetativum in foveam crateriformem immersum. Ramificatio subpyramidalis, ramis sparsis, clavatis, ca. 250μ latis inferne tenuioribus, superne subcylindricis trichoblastos numerosos

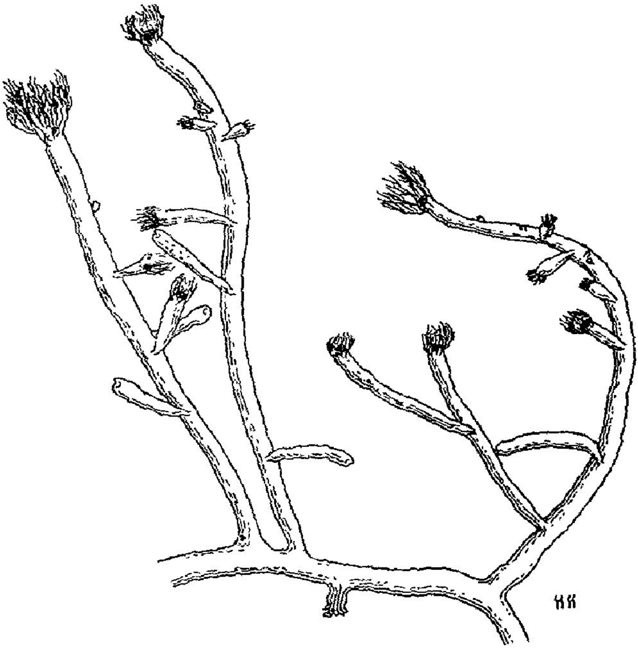


Fig. 9.—Chondria transversalis Boergs. Habit of plant. × 9.

gerentibus. Cellulæ epidermales elongatæ-subquadranguleres ad 140μ longæ et ca. 30μ latæ; cellulæ subepidermales oblonge-hexagonæ, ca. 140μ longæ et ca. 15μ latæ in series transversales regulares ordinatæ.

Tetrasporangia in superiore parte ramorum præsentia.

I n d i a: Off Tuticorin near Hare Island dredged at about 20 meters on 1st March 1928, BOERGESEN 5737 (type).

This little *Chondria* (Fig. 9), creeps on stones and shells in rather deep water. The thallus is tere.e and composed of decumbent creeping filaments from which the erect ones arise. The creeping filaments are fixed to the substratum by means of short, thick rhizoids. The thickest thallus found was about 450μ broad, but the most common breadth is 350-400μ, the branches reach a breadth of about 250μ. The erect filaments are up to 1½ cm. high. The ramification is pyramidal, branches being given out on all sides from the main branches. The branches at their base are narrowed often to almost half their size, upwards they are cylindrical keeping nearly the same size until the truncate or broadly rounded apex with the sunken growing point in the middle from which the often numerous trichoblasts protrude. The surface cells (Fig. 10a.) when seen from above are elongated

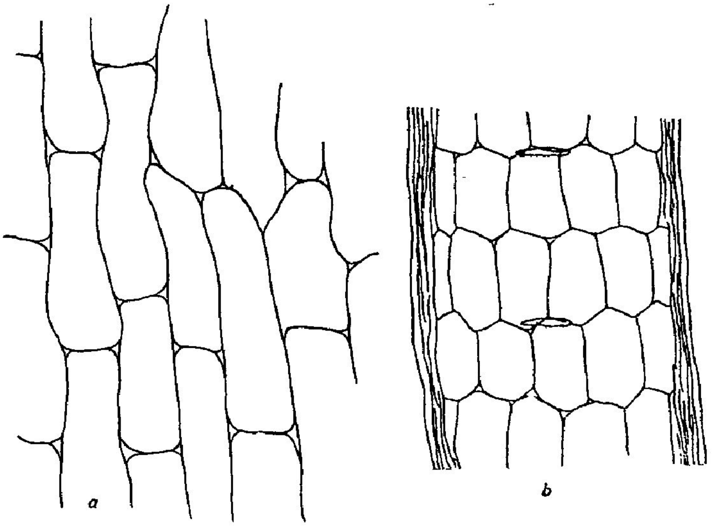


Fig. 10—*Chondria transversalis* Boergs. *a*, cortical cells seen from above. *b*, subcortical. cells *a*, × 265. *b*, × 90.

quadrangular, up to about 140μ long and 30μ broad. The cells under the surface cells are clearly observable. They are elongated hexagonal (Fig. 10b) about 140μ long and 75μ broad and arranged in regular transverse rows. Also the central cells and especially the thick transverse walls of these are visible. The central cell and the pericentral ones are twice as long as the subcortical cells forming the transverse rows. A transverse section shows (Fig. 11) in the middle the central cell and 5 pericentral cells; these are surrounded by the large subcortical cells which are in their turn surrounded by the peripheral cells which are roundish-quadrangular in transverse section and are firmly connected with one another in contrast to the cells of the interior which are more loosely connected with one another. The tetrasporangia are formed in the upper ends of the branches.

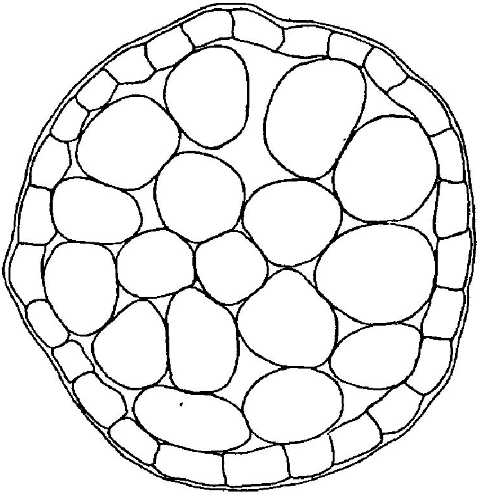


Fig. 11.—*Chondria transversalis* Boergs. Transverse section of the thallus × 265.

This species seems to resemble very much *Chondria simpliciuscula* Weber in Rhodophyceae of the Percy Sladen Trust Expedition (Transactions of the Linnean Soc. of London, Zoology, vol. 16, 1914, p. 289, pl. 16, figs. 9-10), although, judging from the description and rather schematic figures, it differs in several respects. The Indian plant agrees with *Ch. simpliciuscula* in being small (exact measurements of the latter are not given) and in having a decumbent creeping thallus. Furthermore, the hexagonal shape of the cortical cells near the apices of the

filaments is about the same in both species and the tetrasporangia are formed in the upper ends of the ordinary branches. As regards the differences between the two plants, it must be mentioned that in the old parts of the thallus in Mme. WEBER'S plant the superficial cells have undulated walls and become thus moniliform, whereas, in the Indian plant, these cells are long and subrectangular with straight walls. Further, Mme. WEBER'S plant is an epiphyte creeping on *Laurencia papillosa* and thus must be presumed to live in shallow water while the Indian plant was found in deep water fixed by means of rhizoids to small pieces of stones and shells. Besides, as the description given above clearly shows, the Indian plant differs essentially from *Ch. simpliciuscula* in several other respects also.

Sub-fam. 3. ***Polysiphonieæ***

Polysiphonia Grev.

Polysiphonia Tuticorinensis nov. spec.

Cæspes erectiusculus ca. 12 cm. altus, fastigiate-virgatuss fuscopurpureus. Fila ecorticata ex articulis 4-siphoneis composita, a basi ramosa ramos sparsos quoqueversum egredientes, erectos, axillis acutis gerentia, inferne ca. 400μ lata, moniliformia, superne gradatim tenuiora et cylindrica. Articuli in tota planta conspicui sæpe paulo atiores quam longiores. Rami in loco pilorum oriuntur.

Tetrasporangia pauca (1-3) in ramulis torulosis spiraliter seriata in superiore parte filorum præsentia; segmenta fertilia, ca. 70μ lata, tetrasporangia 50μ lata.

Cystocarpia oblonge-urceolata, ca. 250-280μ longa et 180-250μ lata, in superiore parte cellulis permagnis ostiolum apicalem cingentibus ornata.

Antheridia elongate-conica, ca. 160μ longa et 40μ lata. superne cellulas sterilĕs 1-3 gerentia.

India: Hare Island, 2nd March 1928, BOERGESEN 5764 (type).

The plant (Plate VIII) forms a dense very much ramified tuft about 12 cm. high. Its method of growth is pyramidal with scattered upwardly erect branches all along the main filaments. The plant has four pericentral cells and no cortical layer. In the lower part the main filaments are about 600μ broad or more (?), tapering slowly upwards. In the older lower parts of the thallus the filaments are moniliform, but higher up they are cylindrical; the segments are about as long as broad or a little shorter, for instance, in one filament with a breadth of 352μ the segments were 242μ long, and another filament which was 275μ broad had segments about 220μ long. The trichoblasts are well developed

in the young upper parts of the filaments (Fig. 12a); they are placed spirally to the left with $\frac{1}{4}$ circumference between them in such a way that the 5th trichoblast is situated over the first one. Now and then a branch is given off instead of a trichoblast.

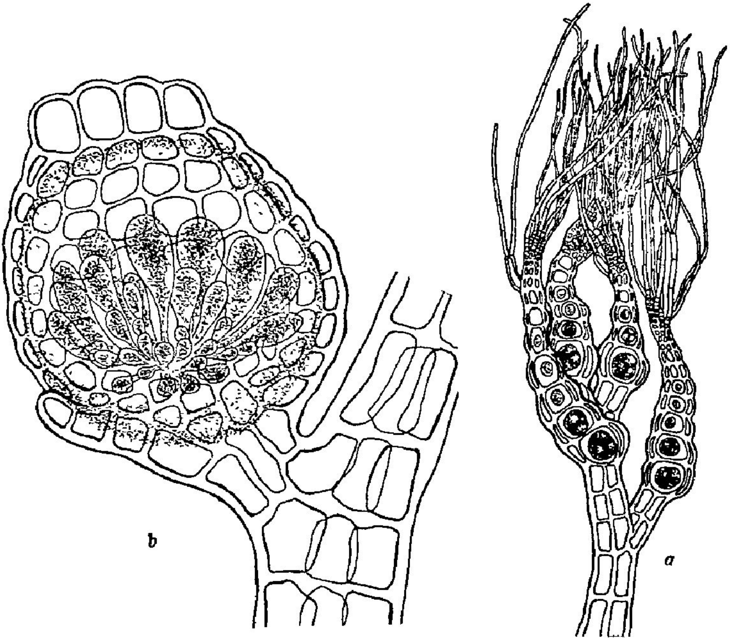


Fig. 12—*Polysiphonia Tuticorinensis* nov. spec. *a*, filaments with tetrasporangia *b*, a cystocarp. *a* × 70; *b*. × 135.

The tetrasporangia (Fig. 12a) are developed in short rows. As a rule 2 (1-3) well developed tetrasporangia are found and above these a few badly developed ones. One sporangium is developed in each segment These become swollen very much making the branch more or less screw-shaped. The fertile segments reach a breadth of 70μ and the sporangia a breadth of about 50μ.

The cystocarps (Fig. 12b) are elongated-urceolate about 250-280μ long and 180-240μ broad, the neck is rather long and about 115-130μ broad, and the large cells forming uppermost a ring round the ostiole are about 20μ high.

The androphores (Fig. 13) are formed by the first side-branch of the trichoblasts. They are elongated conical about 160μ long and 40μ broad and have at their upper ends 1-3 short sterile cells. The only male branch found by me was a side branch on a tetrasporic plant. KNIEP in "Die Sexualität der niederen Pflanzen" mentions p. 226 several similar cases found in *Polysiphonia*.

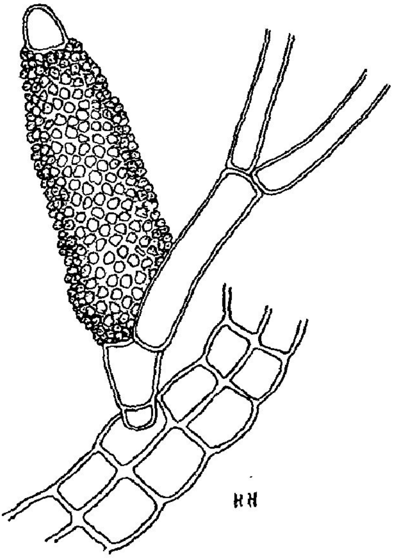
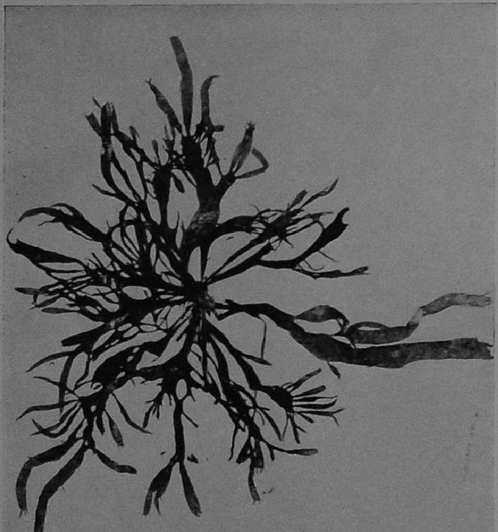


Fig. 13.—*Polysiphonia Tuticorinensis* nov. spec. An androphore × 400.

Polysiphonia Tuticorinensis compared with the species of *Polysiphonia* from India previously described by me is easy to recognize. Thus *Polysiphonia platycarpa* (in Kew Bull., 1934, p. 23, figs. 15-17 and in List mar. Alg. Bombay, p. 60) differs owing to the facts that the cystocarps are more spherical in shape and have no large cells round the ostiole, the androphores have no sterile cells at their summits, and the tetrasporangia are found in long rows. To this must be added the altogether different habit of the plant. *Polysiphonia unguiformis* (Contributions, I, p. 53) differs in the absence of large cells round the ostiole of the cystocarps and in the androphores not having large sterile cells at

the upper ends. The ramification and habit of this plant is also quite different

Owing to the often very incomplete descriptions without figures of many of the almost 50 species with four pericentral cells mentioned in DE-TONI's Sylloge, I dare not deny that some of these might possibly come near to or perhaps be like the present species, but I wish to point out that I have gone through the collections of *Polysiphonia* found in the Kew Herbarium and in British Museum without being able to find any specimens resembling this species.



F. BOERGESEN—*GRATELOUPIA LITHOPHILA* BOERGS.

F. BOERGESEN—*POLYSIPHONIA TUTICORINENSIS* BOERGS.

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